

IN THE DRAWINGS:

Please replace FIG. 5 with the attached FIG. 5. A proposed change shown in red ink has been submitted in a separate paper in accordance with 37 C.F.R. § 1.121(a)(3)(ii). Applicants believe that the proposed change introduces no new matter.

IN THE SPECIFICATION:

Please replace the paragraph beginning at the top of page 3 with the following rewritten paragraph:

36 --The present invention provides a trench transistor with a source that is self-aligned to the gate. A self-aligned source is a source that has been implanted such that a gate material, which is in a trench and separated from the substrate by a gate dielectric layer, acts as an implantation mask during the source implantation step. A self-aligned source therefore has been at least partially implanted through a sidewall of the trench. In one embodiment a gate-source overlap results from an angled implantation step that implants source dopant beneath a portion of the gate. After implanting one edge of a trench, the substrate may be rotated ~~90~~ degrees to implant the other edge of the trench without breaking vacuum or removing the substrate from the ion implanter. The angled implant can provide a consistent, low gate-to-source capacitance, thus resulting in a more uniform and predictable device with lower parasitic capacitance than conventional devices. The angled implant also allows the gate-source overlap to be formed without relying on diffusing source dopant into the substrate, which would otherwise compensate the heavy body dose and reduce the effectiveness of the heavy body. The angle of the implant can be varied to control the relative doping concentration between an active source region and a source contact region. In one embodiment, arsenic ("As") is implanted to form an n+ source region because of the relatively low diffusivity of As in silicon, thus forming an "L-shaped" source region with a distinct interior corner that the heavy body can extend into to enhance ruggedness of the device.--

Marked up versions of the amended claims and specification are attached to the end of this Amendment.

REMARKS

Upon entry of this Amendment, which amends claims 1, 3, 7 and 9, cancels claims 4-6 and adds claims 17-25, claims 1-3, 7-9 and 17-25 remain pending. Previously examined claims 1-4 and 8 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No.

5,298,780 to Harada (hereinafter "Harada") and claims 5-7, 9 and 10 were rejected under 35 U.S.C. § 103(a) as being obvious over Harada in view of Applicant's admitted prior art (FIG. 1). Reconsideration of the claims in view of the above amendments and the comments presented below is respectfully requested.

Claim Rejections -- 35 U.S.C. § 102(b)

Claims 1-4 and 8 were rejected under 35 U.S.C. § 102(b) as being anticipated by Harada.

Harada discloses a vertical channel MOS device. However, Harada does not teach that "a distance of the source from the sidewall" of the trench is "approximately equal to the distance of the extension of the source contact region from the surface", as claim 1 does.

Despite Harada not teaching the above aspects of claim 1, the Examiner states on page 4 of the Office Action that "the thicknesses of the source region and the source contact regions are well recognized parameters of importance subject to routine experimentation and optimization." Applicant respectfully disagrees with this characterization. Harada does not teach how the two distances recited in claim 1 may be manufactured so that they are "approximately equal". Indeed, it should be appreciated that it is the process used in the present invention (e.g. implanting at an angle, etc.), which allows such "approximately equal" distances to be realized. Accordingly, Applicant respectfully disagrees that the "distance of the source from the sidewall" as being "approximately equal to the distance of the extension of the source contact region from the surface" (as recited in claim 1) were "recognized parameters of importance subject to routine experimentation and optimization", as the Examiner suggests.

For the foregoing reasons, Applicant respectfully requests that the § 102 rejection of claim 1 be withdrawn.

Claims 2, 3 and 8 each depend from claim 1, which Applicant believes (as explained above) to be an allowable base claim. Accordingly, Applicant requests that the § 102 rejection of these claims also be withdrawn.

The rejection of claim 4 is moot by the fact that claim 4 has been canceled.

Claim Rejections -- 35 U.S.C. § 103(a)

Claims 5-7, 9 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Harada in view of FIG. 1 disclosed in the present application.

Claims 5 and 6 have been canceled in this amendment. Therefore, the rejections directed at these claims are now moot.

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Claim 7 depends from what Applicant believes to be an allowable base claim (i.e., claim 1). (See comments with respect to the §102(b) rejection of claim 1 above.) Additionally, Applicant wishes to express a disagreement with the Examiner in which the Examiner suggests that the claimed "0.15 micron" extension of the source contact region from the substrate surface is a "recognized parameter[] of importance subject to routing experimentation and optimization." Applicant respectfully disagrees with this characterization. As explained on page 3, beginning at line 15 of the application, there are tangible benefits that result from controlling the junction depth of the source and source contact regions:

"The shallow n+ implant, and hence junction depth, also consumes less lateral distance in the bulk silicon, allowing the heavy body to be larger and more effective, and/or allowing a reduced gate pitch. The result is a cell that can be scaled down for better performance, and improved yield, without sacrificing the ruggedness of the device. For example, a cell pitch of approximately 1.3 μm may be made using 0.35 μm fabrication technology."

For the foregoing reasons, therefore, Applicant believes that claim 7 is in a condition for allowance and, accordingly, respectfully requests that the § 103(a) rejection of claim 7 be withdrawn.

The comments above concerning the § 103(a) rejection of claim 7 apply also to claim 10. Therefore, Applicant respectfully requests that the § 103(a) rejection of claim 10 also be withdrawn.

Finally, claim 9 depends from what Applicant believes to be an allowable base claim (i.e., claim 1). (See comments with respect to the §102(b) rejection of claim 1 above.) Accordingly, it is believed that claim 9 is in a condition for allowance. Applicant respectfully requests that the § 103(a) rejection of claim 9 be withdrawn.

New claims 17-25 are believed to be patentably distinguishable over the prior art of record and, accordingly, are believed to be in a condition for allowance.

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